

## THE HEAD AND THROAT BOTS OF AMERICAN GAME ANIMALS.

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The bots here considered all belong to the genus *Cephenemyia*. The flies of this genus larviposit at the entrance of the nostrils or on or about the nose or mouth of various members of the Cervidæ, and probably at times of certain allied families of ruminants. The newly deposited larvæ gain entrance to the host normally through the nostrils, but no doubt also at times through the mouth. They cling by their spines and mouth-hooks to the mucous membranes near the point of entrance, and feed upon the mucous exudation which their irritation causes the membranes to secrete. On reaching second stage they penetrate farther within. The bots have been found in the following situations in the host:

1. *Nares*.—The nasal cavity is evidently the original habitat of the larvæ, whence they at times migrate or become dislodged and make their way to other nearby parts wherever they can find lodgment.

2. *Nasal Sinuses*.—Often infested and reached directly from the nares.

3. *Frontal Sinuses*.—At times infested and reached from the nares by way of the channel or grooved passage between the turbinated bones. This is the situation meant in the occasional reports of larvæ from the "brain cavity." The brain is evidently never reached.

4. *Eustachian Tubes*.—Reached through the posterior opening of the nares.

5. *Pharynx*.—Failing to become attached at the opening of the Eustachian tubes the larvæ, on emerging from the posterior opening of the nares, frequently find lodgment in the pharynx by securing a hold on its walls.

6. *Soft Palate*.—Reached on falling from the walls of the pharynx.

7. *Base of Tongue*.—Reached as in the preceding or directly from the mouth.

8. *Larynx*.—At times the larvæ, falling from the pharynx and

failing to secure a hold on either the soft palate or the base of the tongue, drop through the open epiglottis and become attached to the walls of the larynx between or beneath the vocal chords.

9. *Lungs*.—In some instances the larvæ lose their hold in the larynx and are compelled to pass down one of the bronchi, thus reaching the lungs. The only case of the kind on record is that mentioned by Brauer, in which a *stimulator* larva was taken from the lung of a roe deer in Europe (Wein. Ent. Zeit., V, 305).

10. *Gullet*.—Reached from the pharynx or mouth.

11. *Throat Pouches*.—Reached from gullet. The formation by the larvæ of these pouches or pockets in the throat constitutes a remarkable digression from the normal, and has evidently resulted from their efforts to escape being swallowed and passed into the stomach.

There are so far recorded from America only three species of this genus. One of these, *C. pratti*, is known in both the fly and third-stage larva. The others are *C. phobifer*, known only in the fly, and *C. macrotis*, known only in the third-stage larva, but it is highly probable that both are the same species. It is with the view of summing up the known facts and calling attention to the desirability of securing further material from all parts of the country that this article is prepared. By rearing the flies, and even by securing alcoholic larvæ from various sources, much can be done toward connecting the flies and larvæ of the same species and determining their range and host relations. The available records and the material so far known may be considered most conveniently in chronological order, as follows:

1815. One male fly collected by J. Abbott in Georgia was described by Bracy Clark as *Æstrus phobifer*, the description being accompanied by an excellent figure (Essay on Bots, p. 69, pl. 2, fig. 30). The figure indicates the male in the comparatively narrow front, the wing venation leaves no doubt as to the genus, and the description is sufficiently clear for the identification of the species. It is known that Abbott lived somewhere between Savannah and Atlanta. Whether he secured this fly in the lower region or back in the hills is unknown but immaterial, as the host no doubt ranged in both districts.

1863. Two third-stage larvæ taken from throat of *Odocoileus*

*hemionus* Raf. (syn. *Cervus macrotis* Say), the mule deer, in the Northwest Territory, transmitted by Baron Osten-Sacken, were described and figured by Brauer as *C. macrotis*, the name being omitted from the description but inserted in the index (Mon. Œstr., pp. 211-212, 279, pl. IX, fig. 9). If there is any doubt about the validity of the name, it was formally applied and thus confirmed by Brauer & Bergenstamm in 1894 (Musc. Schiz., IV, p. 547). The only locality given by Brauer was North America, but Osten-Sacken supplied further details in 1878 (Cat. Dipt., p. 144). The range of the host in the old Northwest Territory was Minnesota, the Dakotas and western Iowa, which means that these bots came from somewhere in that region. The species will be readily identified on the larval characters given by Brauer. It seems very probable that it is the larva of *phobifer*. On larval characters it comes nearest to the European *stimulator*.

1863. Two or more third-stage larvæ taken from throat of *Cervus canadensis* Erxl., the wapiti or American elk, transmitted by Baron Osten-Sacken, were identified by Brauer as *ulrichii*, which is a European species (Mon. Œstr., p. 202). Again only the locality North America was given. The host originally ranged from Massachusetts to North Carolina and westward. Since the larval characters of *pratti* are closely similar to those of *ulrichii*, it seems practically certain that these larvæ from the wapiti were *pratti*.

1883. One or more larvæ taken from throat of *Odocoileus mexicanus* Gmel. (so stated but may have been *coucsi* C. & Y.) in Durango were recorded by Brauer as belonging to this genus (Zweifl. Kais. Mus. Wien, III, p. 82). Brauer & Bergenstamm later applied the name *mexicana* to these larvæ (Musc. Schiz., IV, p. 547). The name is invalid, since it was connected with neither description nor figure. The species, however, is almost certain to be *pratti*.

1884. Three dozen or more third-stage larvæ, taken from *Odocoileus columbianus* Rich. by Dr. Charles H. Townsend in Shasta County, California, bear Smithsonian Accession 17956 and are *pratti*.

1889. Four third-stage larvæ taken from pockets or pouches in the throat of deer near San Jose, California, are *pratti*. This is the material referred to in Insect Life, I, 386-7.

1899. In July and August, I took large numbers of immature third-stage larvæ from the heads of many individuals of *Odocoileus*

*couesi* C. & Y., in the Sierra Madre of western Chihuahua, near Meadow Valley, at about 7,000 feet, which were almost certainly *pratti*. They occurred principally in the nares and pharynx. No pockets in the throat were noted. It was common for a dozen or two to issue from the nostrils and mouth of the host soon after death. Unfortunately none of them was sufficiently mature for the rearing of the fly. The percentage of infestation of the host was very large. Messrs. Nelson and Goldman, of the Biological Survey, were in the same country at this time and noted the same bots commonly in the same host.

On several occasions I saw what I believe to have been the female flies of this species passing with incredible swiftness up and down over the stream in the head of the Rio Piedras Verdes canyon, near Meadow Valley. They flew high overhead, entirely out of reach, and were never seen to alight. About the only impression left by them on the eye was that of a blur or streak of orange or reddish and black, the red dominant. So far as could be judged from these fleeting glimpses, the flies were largely of a deep orange-red or rich red-brown, and seemed to be strongly piliferous. They appeared to be of good size, not heavy of body but rather long of legs, and very strong of wing. They were probably females looking for hosts. The females are somewhat larger than the males in this genus, and the impression of rather long legs was probably due to the extension of the legs below in flight. The pilosity of the extended femora, mostly black, helped to exaggerate the size. The males of the genus are usually met with only on bare mountain tops.

1903. One immature third-stage larva, taken by Mr. H. S. Barber from the nose of a blacktail deer at Bair's Ranch, on Redwood Creek, Humboldt County, California, June 17, is *pratti*.

1910. Eight third-stage larvæ were taken by Mr. F. C. Pratt, of the Bureau of Entomology, from nasal passages of *Odocoileus texanus* Mearns at Sabinal, Texas, in November. Three of these pupated, and two of the pupæ later disclosed male flies. From this material Dr. Hunter, in 1915, described the fly, third-stage larva and puparium under the name *pratti* (Proc. Ent. Soc. Wash., XVII, pp. 169-173, pl. XVI). Examination of the genitalia of the two specimens of the fly labeled allotype and holotype, described respectively as male and female, shows that both are males. The width of vertex

in the allotype is about one fifth of the head-width, in the holotype about one fourth. The abdominal pile of the allotype is nearly all deep black, while that of the holotype is practically all bright rufous, only the tip of abdomen showing a lighter pile mixed apically with black in both cases. I do not consider that these two specimens can represent two distinct species, notwithstanding the differences in frontal width and pile coloration, since they issued from puparia which appear to be identical. Moreover, they came from a lot of eight larvæ all evidently the same species. They simply furnish an emphatic illustration of the scope of variation in the species of this genus.

*C. pratti* is distinguished from *phobifer* practically only in retaining the mesoscutal band of black pile and losing the infusate area of the wing, in both points conforming to the European species. It differs from the European *stimulator*, which it closely duplicates in appearance, by the narrow front of male, short discal abdominal pile, and the restriction of the light pile of femora to the basal region, in all three points conforming to *phobifer*. The larval characters in general approach closely those of *ulrichii*, as stated by Hunter; the anal stigmata, one of the best specific guides, being practically the same. This explains Brauer's determination of the larva as *ulrichii*.

1913. Two flies were taken by Mr. Frank E. Watson, one on the summit of Mt. Marcey, New York, 5,344 feet, on July 3, and the other at North Elba, New York, in July. The latter specimen has been donated to the U. S. National Museum by Mr. Wm. T. Davis and is a male of *phobifer* (syn. *abdominalis* Ald.). Mr. Davis published a note on these two specimens in 1916 (JOURN. N. Y. ENT. SOC., XXIV, pp. 92-93).

1914. Three male flies taken by Mr. Wm. T. Davis on White Face Mountain, in the Adirondacks, New York, were described by Dr. J. M. Aldrich in 1915 as *abdominalis* (JOURN. N. Y. ENT. SOC., XXIII, pp. 145-150, pl. 11). This was the first record to be published on *Cephenemyia* flies of American origin since Bracy Clark's time, and was of unusual interest as indicating the rediscovery of *phobifer* after a lapse of just one hundred years. It emphasizes the rarity of the capture of these flies. Clark's description and figure seem to leave no doubt of the identity of the species. The available data indicate quite positively that the discal abdominal pile of Clark's specimen was

dark, evidently blackish or brownish, that of the tip of abdomen being rufous. Even were the discal abdominal pile of Clark's specimen more or less rufous it would not militate against the reference of the New York flies to *phobifer*, for it appears certain that the color of the pile in this genus varies at times in the same species from pale yellowish and rufous to deep black. The absence of the mesoscutal band of black pile is unique. Above all, added to the other points of agreement, I consider that the peculiar area of wing infuscation, which is also unique, clinches the identity of *abdominalis* with *phobifer*.

*C. phobifer* is to be distinguished from the European *trompe*, which it almost exactly duplicates in appearance, by the narrower front of male, loss of the mesoscutal band of black pile, restriction of light pile of femora to basal region, shortness of abdominal pile, and infusate wing-area. Its distinction from *pratti* has already been pointed out.

1914. Seven third-stage larvæ taken by Mr. J. J. Rauers, March 27, from "brain cavity" (probably frontal sinuses) of a deer on the game preserve of St. Catherine Island, Georgia, form No. 17321 of B. A. I. Parasite Collection and are *pratti*. I am indebted to Dr. B. H. Ransom, of the Bureau of Animal Industry, for the opportunity of examining this material. This locality is on the coast just south of Savannah. It seems, therefore, that the range of *pratti* extends from the Pacific coast and southwestern regions eastward through the Gulf coast region to the south Atlantic coast of the United States.

1915. Two dozen or more third-stage larvæ, taken by Mr. J. S. Ligon, in February, in the larynx of a male *Odocoileus hemionus* Raf., at Aragon, Socorro County, New Mexico, are *pratti*. I am indebted to Mr. E. W. Nelson, chief of the Bureau of Biological Survey, for the opportunity of examining this material. The larynx was excised, with the bots in situ, and sent in alcohol. About a dozen of the bots were still massed within it, attached more or less firmly to the mucous lining of its walls. The locality is in extreme western Socorro County, on the Rio Tularosa near Old Fort Tularosa, and is mapped by Bailey as Upper Sonoran.

The above records cover all the references and material available to me on *Cephenemyia* of American origin. The Patagonian species described by Guerin as *grandis* is not this genus, but either *Rogen-*



*hofer* or a new genus. It is evidently a subcutaneous bot, and not a head or throat bot.

The larvæ recorded in *Insect Life*, II, p. 116, from nasal passages of man in California are third-stage screw-worms, *Cochliomyia macellaria* Fab. I have examined the material, which is now in the U. S. National Museum.

The larvæ from the throat of hogs near Parkersburg, West Virginia, recorded in *Insect Life*, III, pp. 161-162, are not *Cephenemyia*, nor are they any other known cæstrid genus, nor yet screw-worms, Sarcophagids, nor Muscids (Calliphorids). The material, now in the National Museum, consists of a single immature third-stage larva of decided cæstrid aspect, with double mouth-hooks and elaborately sinuous anal stigmatic slits.

It is evident from the foregoing that our knowledge of *Cephenemyia* in America is extremely defective. The flies themselves are seldom met with and usually difficult to capture. The male flies especially frequent mountain tops and collectors who visit such places would confer a great favor by capturing them. While they fly with extreme swiftness, they are at times found resting in sunny places. The female flies are less often found on mountain tops but frequent the haunts of the host. It appears that the only practicable way of securing them in the open is to shoot them with .22 caliber cartridges loaded with dust shot or fine sand. No American female flies are yet known in collections.

Occasionally other ruminant hosts than *Cervidæ* may be attacked by the flies of this genus. I have recently secured authentic information of bots in the heads of the pronghorn antelope, *Antilocapra americana* Ord, which is of extreme interest in this connection. Mr. Otto Schoenberg, superintendent of the Cedro Ranger Station, Manzano National Forest Reserve, who spent twelve years with the Apaches in Arizona, tells me positively that he has taken large bots from the nasal cavities of the antelope in central Arizona years ago. This is the first record of the kind known to me, and I consider the authority unquestionable.

The greatest service can be rendered by persons who have opportunity to examine fresh game heads in whatever locality. The best chance of finding mature larvæ, from which the fly can be reared, appears to be in winter or early spring. Mature bots from the heads

and throats of all possible wild ruminant hosts are greatly to be desired. Such hosts are the various deer, wapiti, various caribou, moose, all belonging to the family Cervidæ; and pronghorn, various mountain sheep, Rocky Mountain goat, musk-ox, belonging to other families of ruminants. The bots should be sent alive, packed in loose dry earth in tin receptacles.

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## NOTES ON LEPTOBYRSA RHODODENDRI HORV.

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The writer has been interested in observing this insect in New Jersey during the past few years and presented a brief paper on its development and habits at the fifth annual meeting of the Entomological Society of America in December, 1910. Recently the synonymy of this species has been noted in the Entomologist's Monthly Magazine and it seems opportune therefore to bring this to the attention of American entomologists and to record some additional notes on this insect.

The species, which was redescribed by Heidemann under the name *Leptobyrsa explanata* (Proc. Ent. Soc. Wash., X, p. 105-108, 1908) and which has been considered under the latter name by American collectors, was first described by Horvath as *Stephanitis rhododendri* in 1905 (Tingitidæ Novæ et Minus Cognitæ e Regionæ Palearctica in Ann. Mus. Hung., Vol. III, p. 556). As this description may not be available to some of our American students I include it herewith: "Pronoto elytrisque hyalinis, pallido-reticulatis et pilis brevibus erectis griseis sat dense obectis: capite nigro, buccibus albidis, fere ubique æque altis et antice ultra apicem tyli prominulis; antennis albido testaceis, brevissime pilosulis, articulo ultimo apicem versus nigro, pronoto disco brunneo, utrinque prope vesiculam anticam nigro, lateribus foliaciis late explanatis, irregulariter quadriseriatim areolatis, vesicula antica oblongo-elongata, sat humili, carina mediana quam vesicula antica haud vel parum altiore, carinis duabus lateralibus antice vesiculam anticam attingentibus: elytris abdomine multo longi-